Cement MILL SECTION of

Concrete

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Welded Rotary Kilns, Coolers and Bins

Modern Lime Burning Plant for Union Carbide Co.

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Lime burning in the United States until about 20 years ago was very crude and very little attempt was made at the installation of labor saving equipment and machinery. This was principally due to the fact that lime was used chiefly in building operations and was usually burned close to the point at which it was used—principally in stone kilns fired by wood and operated by farmers during the winter season.

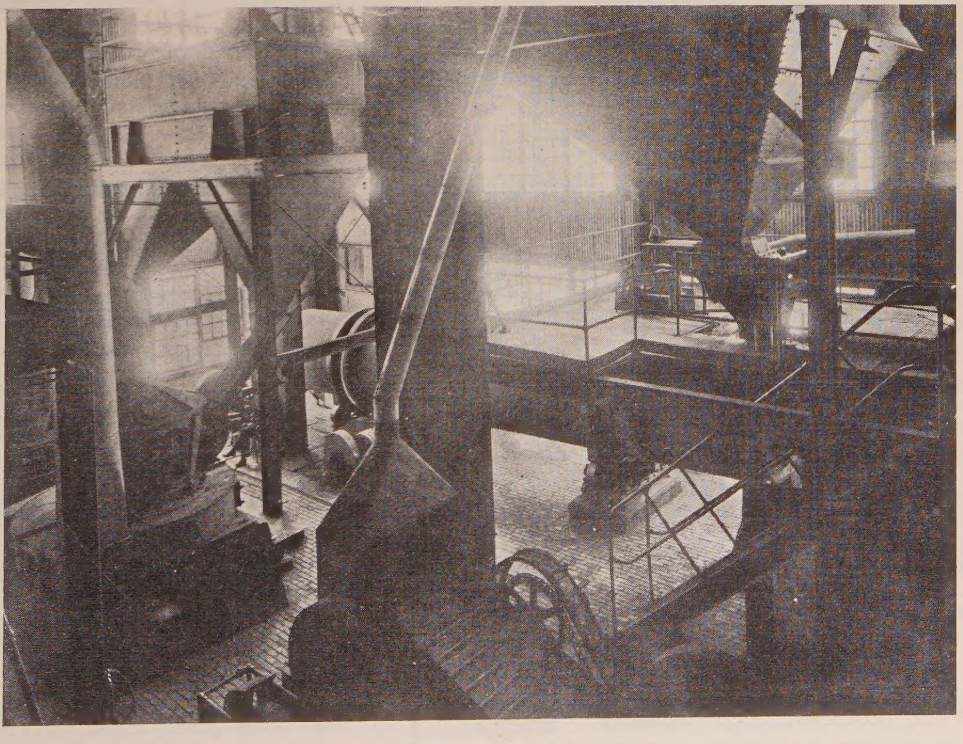
With the diminishing supply and high cost of wood for fuel, lime burners turned their attention to the coal fired lime kiln. The steel kiln lined with fire brick was the next development and a great improvement. The vertical steel shells as finally developed were usually about 12 ft. in diameter by about 50 ft. high and were fired either with coal burned on grates in combustion chambers, or Dutch ovens connected to the vertical shaft of the kiln, or by means of producer gas. With a coal fired kiln it was difficult to get a long flame to which the lime burner who had used wood was accustomed, and various arrangements were devised to increase the length of the flame and obtain greater output and efficiency.

Some burners injected steam under the grates, which they claimed improved the burning quality of the flame and did not over-burn the lime.

Patents were taken out for drawing off a portion of the products of combustion, including the carbon dioxide gas, by means of a fan and blowing these products of combustion through the fire pit, which was claimed to increase the length and reduce the intensity of the flame and thus make a better burned lime.

Some installations use a mixed feed, where the limestone

Fig. 1 — Pulverized coal plant, showing Raymond pulverizers, dryer, bins, elevators, etc.



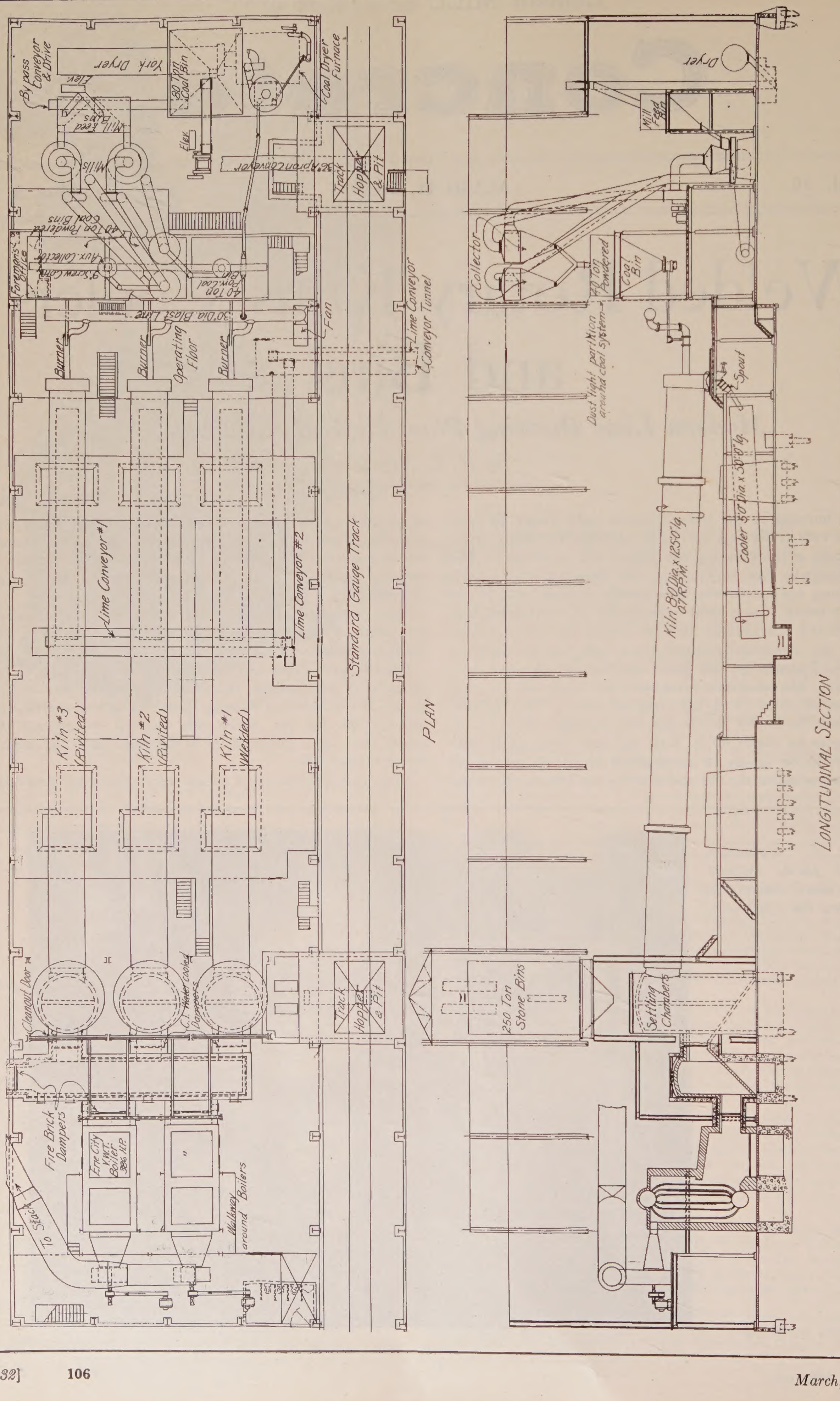


Fig. 4—Plan and sectional elevation showing arrangement of kilns, coolers and other equipment for lime burning in plant of Union Carbide Co.

and fuel, usually coal, are charged into the kiln in alternate layers and as burning progresses the lime is drawn out at the bottom. This lime is contaminated with ash and is discolored but for uses where it will serve the purpose it is cheaper than lime burned by producer gas or separate coal fire. But for work requiring high calcium content, this lime is entirely too impure.

A very efficient type of the vertical kiln was made on Broomell's patent by the Broomell, Schmidt Steacey Co. of York, Pa. By using producer gas in this type of kiln it is possible to produce a very pure chemical lime, provided the stone is pure to start with, as there are no impurities introduced into the lime during the burning process.

Vertical kilns of this type using natural draft had a capacity of from eight to twelve tons of burned lime per 24-hour day, depending upon the quality of stone fed to the kiln. (High calcium stone usually gives a smaller output and requires more fuel than a dolomite stone.)

We have found in our installations that by putting in a suction fan and drawing the products of combustion from the top of vertical kilns of this character, thus taking the carbon dioxide away from the stone as fast as it was formed, the capacity of the kilns could be very much increased and an average output could be obtained of 25 tons per 24-hour day, and an output for limited periods of 30 tons per day.

The serious drawback to the vertical kiln is that proper draft cannot be obtained if the stone is small or with stone which breaks up with the application of heat. In a large lime burning installation it is, therefore, necessary to sell the fine stone as a by-product or, if it is in a location where fine stone is not salable, to waste it.

There may have been previous attempts to burn lime in a rotary kiln but the first successful attempt of which we have any record was made at Natural Bridge, N. Y., in 1906 by the New York Lime Co. A patent was taken out on the burning of lime in a rotary kiln by means of producer gas. This pioneer rotary kiln plant attracted a great deal of attention from lime burners and engineers and was described more or less in detail in the technical papers at the time. The claim was made that six pounds of lime could be burned per pound of coal, and that by using producer gas and a high calcium stone, a very pure lime could be obtained with probably only 2 or 3% of impurities.

In 1903 and the following years the Union Carbide Co. installed a battery of 16 vertical Keystone lime kilns at its plant at Sault Ste. Marie, Mich. Later it was determined that it would be an economical move to replace the vertical kilns with rotary kilns and thus be able to use fine stone; in fact, crush the entire quarry output to the proper size. It was also found from experience with rotary kilns at other plants of the company that the cost of labor and the cost of maintenance was very much less than that with vertical kilns. The first cost, of course, is much greater and the efficiency in pounds of lime per pound of coal is somewhat less, although with the proper installation of both types of kilns there is not a great difference in the latter respect.

Before this replacement was undertaken it was estimated by the engineers that due to the particular conditions prevailing at this plant there would be sufficient saving in operating costs to pay for the new plant in from two to two and one-half years and the operating experience of one year shows that this estimate is being borne out by the facts.

It was decided to install three rotary kilns 8 ft. in diameter by 125 ft. long. In order to properly cool the lime so that it could be handled by the conveyors, three rotary coolers 5 ft. in diameter by 50 ft. long were to be installed directly underneath the kilns. Experience has shown that these coolers, which are fitted with diaphragms cutting the lime stream into quarters, do cool the lime so that it can be handled by a canvas belt conveyor, armoured with strips of steel.

Having determined by previous development work that satisfactory chemical lime could be burned in rotary kilns by pulverized coal, it was decided to use pulverized coal. Accordingly two low side Raymond pulverizers were installed together with the necessary dryer, elevators, conveyors, feed bins, and auxiliary equipment. This pulverizing system was laid out by the Raymond Bros. Engineering Co., Chicago, Ill., and has been very successful.

The pulverizing plant was designed to have sufficient capacity so that all the pulverizing for a day's run could be done in 16 hours and it is, therefore, run on two shifts per day, while the rotary kilns run continuously on three eight-hour shifts per day.

In installing the pulverizing system it was necessary to pay particular attention to coal dust escaping into the air—the cause of many dust explosions. This required very careful attention to details: making the pulverizer absolutely tight, the piping all welded or soldered, and the powdered coal bins and the dryer shells oxy-acetylene welded.

The crushed limestone is delivered on the company's docks by self-unloading boats during the season of navigation and stocked. It is reloaded as needed by locomotive cranes and steam shovels into steel hopper standard gauge cars which in turn are shifted to the car shed adjoining and forming a part of the lime kiln building. If the stone is frozen, as frequently happens during the winter, it is allowed to stand in this car shed and thaw out, the thawing being accelerated by steam jets. The limestone is discharged from the hopper cars into track hoppers from which it is taken by apron feeders and large bucket elevators to the top of the building and distributed into three 250-ton bins. From these it is fed into the kilns in measured quantities by means of reciprocating feeders.

The kilns are fired by means of Raymond pulverized coal burners to which the correct amount of air for combustion is furnished by an auxiliary fan. There has as yet been no attempt made to pre-heat this air for combustion, but this particular feature is now being worked out.

The capacity of each of these 8 x 125 ft. kilns is approximately 100 tons of thoroughly burned lime in 24 hours, although regular practice is to run them at somewhat less than capacity.

The lime as delivered from the coolers is clean, white and very well burned. After leaving the coolers the lime is carried by an armoured canvas belt conveyor across the building and discharged upon another conveyor. The latter runs over a weightometer, by means of which the amount of lime burned is weighed and recorded, and then to the elevators and bins in the storage building. The lime is eventually fed to mixers and finally to the carbide furnaces.

The construction of this plant was begun in December 1922, but on account of the severe winter very slow progress was made. It was December 5th, 1923, before lime was being burned continuously, but since that time the plant has operated very satisfactorily.

The construction of the plant offered no great difficulties although the foundations were difficult on account of the fact that the site of the plant was the original shore line of the St. Mary's River and was underlaid with soft, river silt. It was, therefore, necessary to drive 406 wooden piles about 40 ft. long for the foundation and to cap these piles with more than 1700 cu. yds. of concrete.

The building housing the kilns and equipment is of structural steel weighing approximately 870,000 lbs., including all supports and platforms, and the framing is covered with 285 squares of corrugated zinc roofing and 230 squares of corrugated steel siding.

In order to avoid the danger of dust explosions the pulverized coal plant is cut off from the kiln room by means of a dust-proof partition of steel girts, metal lath and plaster. The firing end of the coal dryer is separated from the pulverized coal room by a dust-tight plastered tile partition.

The coal dryer is arranged to be fired either by hand or by pulverized coal. In ordinary operations a small pulverized coal flame is used and by maintaining the proper temperature

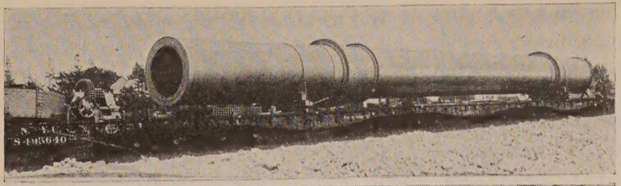


Fig. 2—*Oxwelded rotary kiln loaded on four flat cars*

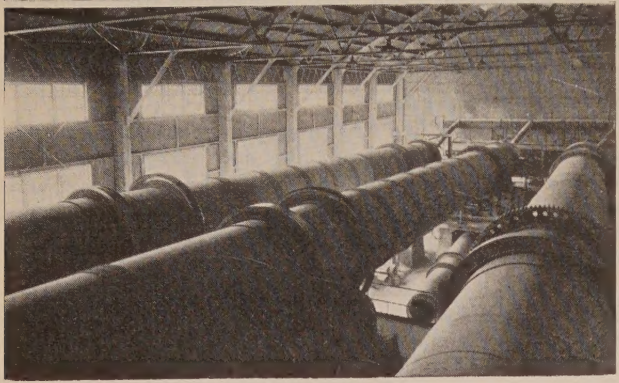


Fig. 3—View of three kilns looking toward firing end showing cooler in foreground

the coal is dried sufficiently without becoming hot enough to risk spontaneous combustion in the bins.

Not only must the partitions and bins be tight, but the dryer, kilns and coolers must also be tight. The inner and outer shells of the coal dryers were oxy-acetylene welded by the builder, the McGann Manufacturing Co., of York, Pa., under consultation with the engineers of the Linde Air Products Co., New York City.

The outer shell of this dryer is 70 in. in diameter by 35 ft. long. It revolves true on the trunnions and has proved to be absolutely dust-tight.

Three rotary cement kilns manufactured by Reeves Bros. Co., of Alliance, O., were installed. Two of these kilns were built according to conventional riveted cement kiln design, while the third kiln, in place of having a riveted shell, was welded by means of the oxy-acetylene flame.[1] Each of these kilns is 8 ft. in diameter by 125 ft. long and is carried on two tires, 14-in. face, supported by a four-roller base.

Since welded kilns of this size were an absolutely new venture, it was decided to weld only one and compare it with the riveted kilns as to strength and accuracy. The welding of such a large shell formed of $\frac{5}{8}$-in. steel plates was in itself a new departure for the welders, but the builders, the Reeves Brothers Co. solved the problem successfully with the assistance of the engineers and service operators of the Linde Air Products Co.

It was necessary to devise entirely new methods for welding these cylinders and considerable difficulty was encountered by the welders in taking care of the expansion and contraction of the plates during the welding process. That the result was achieved successfully is witnessed by the accompanying illustration of the welded shell loaded on four flat cars. It is undoubtedly the largest and heaviest piece of oxy-acetylene welded equipment ever made.

The engineers realized that probably the most difficult problem in welding a cylinder of this size was to keep it straight so that it would run true on its trunnions when completed. They were agreeably surprised upon testing this kiln to find that it was more nearly true than the riveted kiln. The specifications allowed the end of the kiln to be $\frac{3}{4}$ in. out of true when revolved on its trunnions, while the actual test of the welded kiln showed that it was only $\frac{3}{8}$ in. out of true when so revolved.

Three rotary coolers 5 ft. in diameter by 50 ft. long were oxwelded from $\frac{3}{8}$-in. plate, but after welding the $\frac{5}{8}$-in. plates in the large kiln these coolers did not present a difficult problem.

The principal advantages of an oxwelded shell are the smoothness of the inside, which makes lining with brick easier. The appearance of the outside is also improved. Furthermore, a properly welded shell should be stronger than a riveted shell, as tests were made on specimens of the same thickness as the kiln shell, which tests developed at least 80% of the total strength of the plate in the welded joint. It is believed that welded shells will show a lower cost of repair and upkeep as it has been found by experience in other plants that it is necessary to renew loose rivets in the shells from time to time, due to the reversal of stress in the revolving cylinders. These kilns have been in continuous operation since December 5, 1923, under heavy loading and the welded kiln has shown no sign of weakness. It is easier to line than the riveted kiln. The repair costs on the welded kiln are being kept separate from the riveted kilns in order to determine over a period of time the facts regarding the maintenance costs.

Those who may be interested in more details regarding the welding of these large cylinders are referred to a paper read by Raymond R. Orwig, assistant works manager, Reeves Bros. Co., Alliance, Ohio, before the International Acetylene Association at Chicago on November 16th, 1923, and published in the *Acetylene Journal* of January 1924.

The cylindrical stone bins were riveted but the pulverized coal bins were oxy-acetylene welded in place in order to make them absolutely dust-tight. This result has been achieved as the powdered coal room is perfectly clean and free from dust and there are absolutely no leaks from these powdered coal bins.

In order to increase the efficiency of the plant it was decided to pass the combustion gases from the kilns through waste heat boilers. Accordingly two 386-h. p. vertical Erie water tube boilers were installed. These work under a steam pressure of 165 lbs. and have been very successful in operating—in fact one boiler is sufficient to heat the plant in the coldest weather which requires approximately 5440 lbs. of steam per hour. There is available sufficient surplus hot gases to develop about 500 h. p. This will probably be utilized at some future time as the carbide plant requires no steam except for heating, all of the power for electric furnaces and motors being hydro-electric power furnished by the Michigan Northern Power Co.

The waste gases are drawn through the boilers by means of two water-cooled fans and have a temperature of approximately 450° F. after passing through the boilers. It was anticipated that trouble might occur in the boilers from the settlement of lime dust on the tubes and accordingly many openings were provided for blowing off the tubes.

A departure from standard rotary kiln practice was in connecting all three of the kilns to a single brick stack by means of a common flue. The connections to the stack and flue are so arranged that if no gas is passing through the boilers for the time being, it passes into the main flue and direct to the stack. This brick stack is 175 ft. high by 7 ft. inside diameter at the top, and is expected to be much easier to maintain than three separate steel stacks, the usual practice. In order to control the draft on the kilns it was necessary to install a damper in each kiln neck and since no ordinary damper would stand the temperature, a water-cooled damper was developed which has served the purpose admirably. It is possible by means of these dampers, which are controlled by the lime burner, to regulate the draft on the kilns at will.

This plant has now been in operation since December 5, 1923. As with all new installations, certain adjustments were found necessary at first, particularly to the burners on which there has been very little lime burning experience. However, the operation of the plant, taken as a whole, has been very satisfactory.

The design of the plant was prepared in the office of the chief engineer of the Union Carbide Co. The foundations, buildings, bins and trackage were carried on by contract, while the setting of the kilns, coolers and machinery was done by the company's construction force.

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[1] Cement Mill Edition of CONCRETE, Vol. 24, March, 1924, page 42.

A Well-Equipped Australian Plant

Aerial Cable-ways Transport Material from Quarry to Plant—Railroad-Type Shovels Mounted on Caterpillars are Feature of Limestone Quarry

We have always been led to believe that here in the United States we have reached the acme of perfection in highly organized cement plant production, and perhaps we are justified in believing so, but there is one foreign operation which may well serve as a model to us here in this country, from which a lesson or two may be drawn. We refer to the plant of the Kandos Portland Cement Co. in Kandos, New South Wales.

LOCATION

Kandos, a city of 2500 inhabitants, surrounds the company's works in the southern part of New South Wales in the Blue Mountains, not far from the coast, and is situated on the Mudgee Division of the New South Wales Government Railways between Sydney and Mudgee. At this point, the complete process up to the finished product is carried out, raw materials and coal being within easy haulage distance.

THE QUARRY

The limestone quarry is located three miles west of the town and works, and is connected thereto by aerial cableways. The material here consists of a 90% calcium carbonate and it is said that enough material is in sight to last for several centuries. The quarry has a varying height up to 150 ft. from the floor, and has a length of 1500 ft.; it is uniformly clean and safe with practically no overburden. The usual practice of blasting is to fire sets of 6 or more vertical holes drilled the full depth of the face by a churn drill in conjunction with shorter holes into the toe, whereby this portion is blown clear immediately before the mass of rock falls, thus facilitating loading.

SHOVEL OPERATION

The excavation is done entirely by two modern railroad-type shovels, a Bucyrus 68-C mounted on caterpillar traction and equipped with a 2½-yd. dipper and a Bucyrus 103-C shovel also mounted on caterpillars and equipped with a

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Excerpts from an article in *The Excavating Engineer* describing the Kandos Cement Co.'s. plant at Kandos, New South Wales.

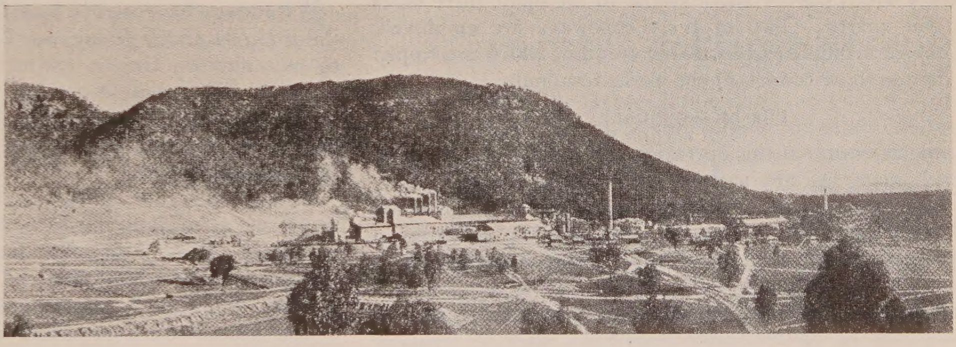


Fig. 1—A view of the factory looking south. Close scrutiny of the view will reveal the unloading terminals and the smoking kiln stacks at the left center. The coal mine referred to in the article is on the hill in the background. At the right are the copper smelters, and the Mudgee line of the New South Wales Government railway may be seen at the extreme right. The large stack in the center right is that of the power station, 175 ft. high with a 6-in. wall

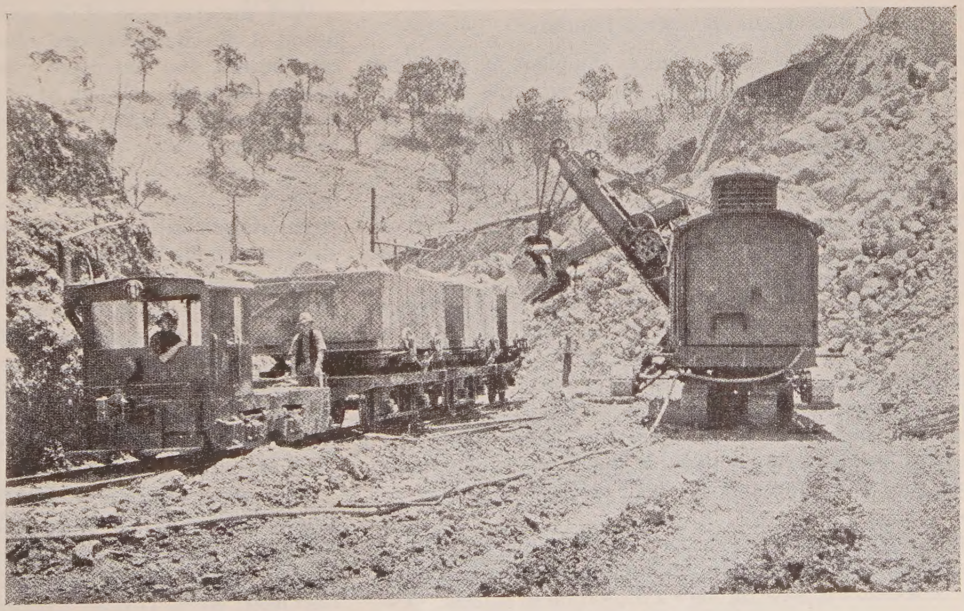


Fig. 2—The Bucyrus 68-C is seen here loading into 12-ton dump cars hauled by a 220-volt direct current locomotive. The shovel, as may be seen, is mounted on caterpillars. This company also owns a Bucyrus 103-C shovel which is mounted on caterpillars, and was recently put into operation

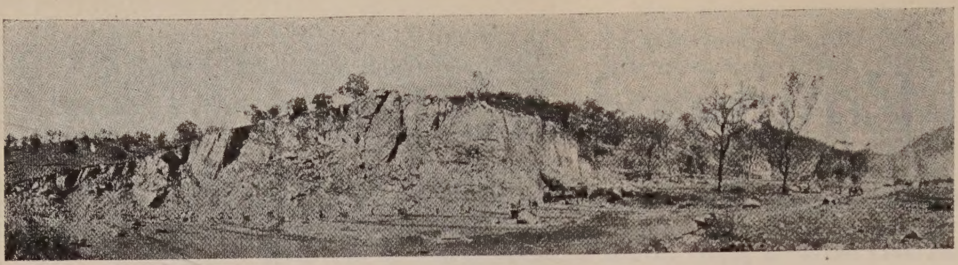


Fig. 3—Quarry, looking north with crusher building at the right. The height of the working face is 150 ft. in the center, and the length about 1500 ft.

3½-yd. dipper. Both shovels are electrically operated. Electric power is obtained from a substation which is connected to the works power house by a duplicate 5000-volt alternating current transmission line. In the substation duplicate three-phase transformers step down a portion of the supply to 440 volts alternating current, on which the shovels are operated.

The shovels load the material into 12-yd. standard-gage dump cars, hauled by electric locomotives, which operate on a circular track running on an easy down grade through the crusher house. The 12-yd. cars were built to the specification of the company and are automatically operated. When the cars are brought to the crusher, an overhead traveling crane operates a tipping device by engaging a wire rope on the side of the car, which opens the side doors and tips the load into the jaws of the 5-ft x 4-ft. Taylor crusher. This crusher weighs 150 tons and is equipped with an 18-ton swinging jaw, delivering to the conveyor 250 tons of limestone per hour crushed to a 6-in. gage or 518 tons per hour to a 9-in. gage.

The crushed stone is further reduced in the pulverizing mill and from here it is taken by a conveyor to the aerial ropeways which convey the material to the plant three miles from the quarry. Two of these ropeways are employed, each one carrying skips containing one ton, which are tipped over the conveyor tunnels at the works terminal.

The Shale Quarry

A unique feature of this operation lies in the fact that all of the raw materials are within easy distance of the plant. The shale, which is an important constituent of the finished product, is quite close to the end of the works, and is taken out in horse-drawn carts, the output required being but a fraction of the limestone. This product is mixed with the crushed limestone in proportions which are determined by the impurity of the limestone from tests made at frequent intervals.

The Manufacturing Process

When the limestone is delivered to the plant by the aerial ropeways from the quarry, it is mixed with the necessary amount of shale and conveyed to the dryers. These are similar in appearance to the kilns, being cylinders which rotate on an axis and expose the material to the heat of furnace gas. After the drying has been completed, the material is elevated into mill hoppers by a Jeffrey conveyor. Four 6-x 30-ft. Compeb mills grind it to a uniform fineness of 92% through a 200-mesh.

From here it is delivered to the silos which provide storage for the raw material. Four kilns 140 ft. long and 7 ft. 8 in. high, two 8-ft. and one 9-ft. diameter, are set with large dust chambers automatically kept cleared of dust, and arranged to be connected to waste heat boilers. Coal is supplied by three small mills after being dried in a double-tube dryer. The kilns are driven by a variable speed motor at approximately ½ r. p. m. and deliver about 500 tons of clinker per day.

From this process the clinker is removed to the fine grinding mills, whence it emerges in its marketable form of fine cement, 90% of which will pass through a 32,400 mesh screen. Two more of this type of grinding mill will soon be added to the plant.

In this story, some attempt has been made to show that the significance of the Kandos Cement Company's work lies in a great measure in the completeness with which every detail has been devised and arranged to produce the maximum of result with the most convenient means. The company has strictly adhered to the policy that speed, continuity and economy of each operation are secrets to its efficiency. Therefore, no effort or expense has been spared to secure the best machinery, the most advantageous layout, both at the quarry and the works, and the best men for the important positions. The Kandos Cement Co. has always, therefore, stood for the best that it is possible to obtain, the only proof of which lies in the excellent product that it produces.

Alumina Cement Factory for Britain

A company has recently been formed in Great Britain under the title of Lafarge Aluminous Cement Co. of Great Britain, to manufacture ciment fondu, the new French aluminous cement. This company is to commence immediately the construction of manufacturing premises on the River Thames, near Purfleet. It is anticipated that the plant will be ready for operation in July.

The site selected covers an area of approximately seven acres, with excellent facilities for road, railway ,and water transport, and practically unlimited supplies of chalk. Bauxite is the only raw material which it will be necessary to import. This will be discharged at the jetties forming part of the works, where provision will be made for the storage of 8,000 tons.

With the exception of the special furnaces required for the fusion of the chalk, bauxite, etc., all details of the somewhat complicated and extensive plant are being ordered from British concerns. Orders have already been placed for steel structures and buildings, crushing and screening plant, briquetting plant, lime kilns, and grinding plant. The works will be electrically driven throughout, and arrangements have been made for the supply of current.

The output capacity of the plant for which contracts have already been made is about 40,000 tons per year, but provision is being made throughout for the installation of additional plant, so that the output may be increased without delay in accordance with increases of demand. As customary in modern cement works practice, the factory will include a laboratory for checking the progress of manufacture and testing the quality of the finished cement, as well as for the conduct of tests and experiments to suit the requirements and ideas of individual customers.

The concern intends to construct a model village of about a hundred houses, for occupation by the workpeople, on land which has been acquired in the immediate vicinity of the works. These houses will be built by arrangement with the Orsett Rural District Council, under the provisions of the Government Housing Act.

Portland Cement for January 1925

The following tables, prepared under the direction of Ernest F. Burchard, of the U. S. Geological Survey, are based mainly on the reports of producers of portland cement. The January, 1925, totals include estimates for five plants. January production exceeds that of all corresponding months; shipments are slightly below those of a year ago but above those of January in all other years; stocks are far in excess of those usually on hand at this period and are exceeded only by those at the end of March, 1924.

Production, Shipments and Stocks of Finished Portland Cement, by Districts, in January, 1924 and 1925, and Stocks in December, 1924, in Thousands of Barrels

Commercial District	Production		Shipments		Stocks at End of January		Stocks at End of December 1924(a)
	January		January				
	1924	1925	1924	1925	1924	1925	
Eastern Pa., N. J., & Md.	2,382	2,267	1,384	1,006	2,830	3,749	2,488
New York	459	533	189	148	923	1,168	738
Ohio, Western Pa. & W. Va.	779	808	360	338	1,481	1,840	1,370
Mich	299	208	196	188	814	986	966
Wis. (b). Ill., Ind. & Ky.	1,346	1,572	635	705	2,257	2,907	2,040
Va., Tenn., Ala. & Ga.	696	967	523	706	631	730	469
Eastern Mo., Ia., Minn. & S. Dak (c)	960	711	296	332	2,518	3,117	2,737
Western Mo., Neb., Kan., & Okla	394	315	278	220	1,260	1,577	1,482
Texas	314	304	287	280	305	379	356
Colo. & Utah	61	80	70	55	261	341	316
Calif.	922	1,075	898	987	373	558	470
Ore., Wash., & Mont.	176	76	94	143	502	368	436
	8,788	8,916	5,210	5,108	14,155	17,720	13,913

(a) Revised. (b) Began producing and shipping June, 1924. (c) Began producing December, 1924, and shipping January, 1925.

Stocks of clinker, or unground cement, at the mills at the end of January, 1925, amounted to about 6,928,000 bbls. compared with 5,433,000 bbls. (revised) at the beginning of the month.

Production, Shipments, ans Stocks of Finished Portland Cement, by Months, in 1924 and 1925, in Thousands of Barrels

Month	Production		Shipments		Stocks at End of Month	
	1924	1925	1924	1925	1924	1925
January	8,788	8,916	5,210	5,108	14,155	17,720
February	8,588	....	5,933	....	16,815	....
March	10,370	....	8,995	....	18,189	....
1st Quarter	27,746	......	20,138	......	......	......
April	11,726	......	12,711	......	17,159	......
May	13,777	......	14,551	......	16,403	......
June	13,538	......	15,036	......	14,903	......
2nd Quarter	39,041	......	42,358	......	......	......
July	14,029	......	16,614	......	12,319	......
August	15,128	......	16,855	......	10,666	......
September	14,519	......	16,827	......	8,404	......
3rd Quarter	43,676	......	50,296	......	......	......
October	14,820	......	17,160	......	6,073	......
November	13,141	......	10,289	......	8,928	......
December	10,435	......	5,506	......	(a)13,913	......
4th Quarter	38,396	......	32,955	......	......	......
	148,859	......	145,747	......	......	......

(a) Revised.

Imports and Exports

The Bureau of Foreign and Domestic Commerce, of the Department of Commerce, reports that the imports of hydraulic cement in December, 1924, amounted to 173,814 bbls., valued at $285,481. The total imports in 1924 amounted to 2,010,936 bbls., valued at $3,116,564.

The imports in December were from Belgium, 82,016 bbls.; Norway, 43,036 bbls.; Esthonia, 33,368 bbls.; Denmark, 8,877 bbls.; England, 3,991 bbls.; Sweden, 1,180 bbls.; Netherlands, 500 bbls.; Canada, 441 bbls.; other countries, 405 bbls.

The imports were received in the following districts: Los Angeles, 56,495 bbls.; Hawaii, 33,654 bbls.; Florida, 13,422 bbls.; San Francisco, 12,504 bbls.; South Carolina, 12,123 bbls.; New Orleans, 10,711 bbls.; Porto Rico, 9,032 bbls.; Washington, 8,680 bbls.; Massachusetts, 8,382 bbls.; Oregon, 7,864 bbls.; other districts, 947 bbls.

The exports of hydraulic cement in December, 1924, were 52,851 bbls., valued at $163,639, of which there was sent to Cuba, 18,089 bbls.; to the other West Indies, 2,500 bbls.; South America, 15,747 bbls.; Mexico, 9,321 bbls.; Central America, 3,354 bbls.; Canada, 487 bbls.; and to other countries, 3,353 bbls. These exports are exclusive of shipments to the following possessions: Porto Rico, 10,633 bbls.; Alaska, 3,866 bbls. The total exports in 1924 amounted to 878,543 bbls., valued at $2,615,154, which exports are exclusive of shipments to Porto Rico, 98,001 bbls.; Hawaii, 53,520 bbls.; Alaska, 19,877 bbls.

The statistics of imports and exports of hydraulic cement in January, 1925, are not available.

Imports and Exports of Hydraulic Cement, by Months, in 1923 and 1924, in Barrels (a)

Months	Imports		Exports	
	1923	1924(b)	1923	1924(b)
January	71,686	153,839	74,169	88,586
February	20,529	162,930	88,531	62,606
March	66,521	160,517	98,861	91,224
April	76,899	148,137	85,662	83,200
May	88,480	161,304	103,634	88,850
June	111,559	196,655	77,203	74,064
July	286,106	108,944	82,774	60,139
August	324,008	192,634	73,201	85,883
September	215,785	138,369	77,121	69,470
October	172,051	214,987	74,302	79,180
November	140,590	198,806	85,743	42,490
December	104,422	173,814	80,487	52,851
	1,678,636	2,010,936	1,001,688	878,543

(a) Compiled from records of the Bureau of Foreign and Domestic Commerce.
(b) Subject to revision.

Cements of High Strength

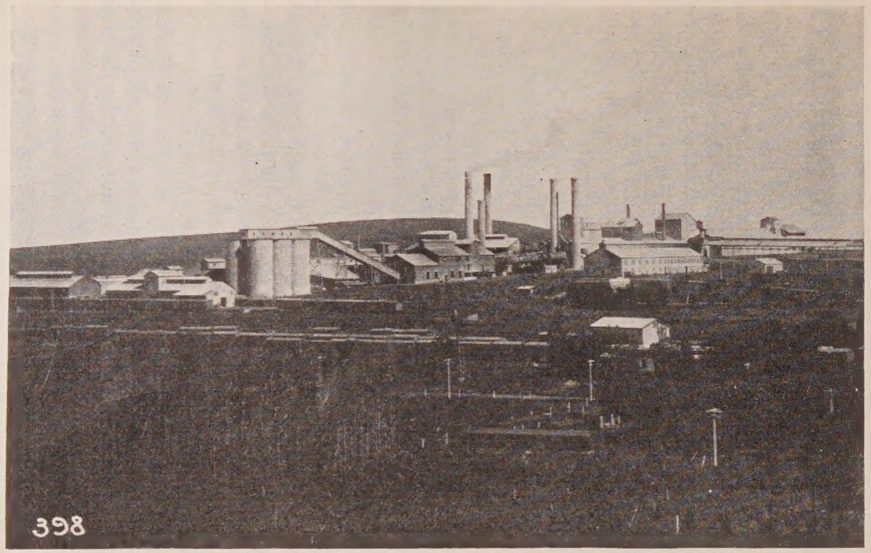
In a study of factors influencing the quality of portland cement by J. Hendrick, and abstracted in the *Journal of the Society of Chemical Industry*, London, England, the author recommends for general practice a standard chemical formula: $xSiO_2$, $2.5\ CaO+yAl_2O_3$, $3\ CaO+Fe_2O_3$, $3\ CaO$, the silica modulus lying between 2.5 and 1.8. These factors include chemical physical composition calcining and quenching, and fineness of grinding of the calcined product.

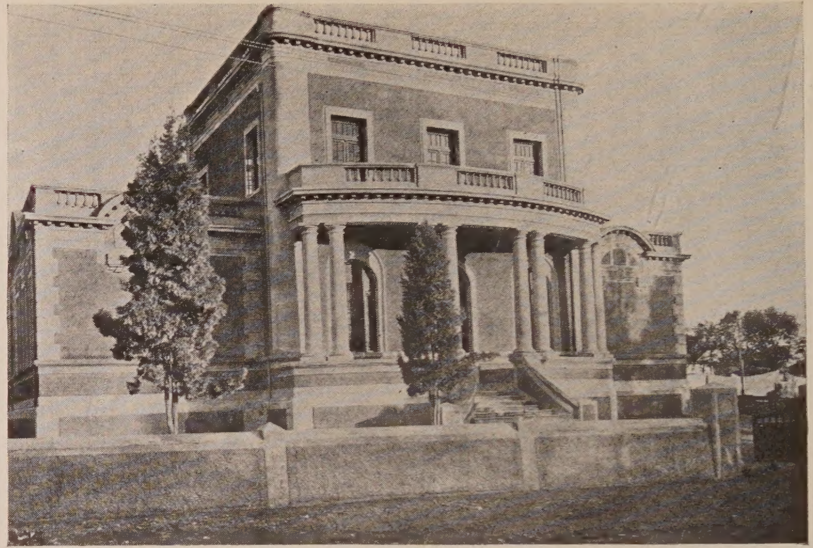
Physical structure can be controlled, less empirically than heretofore, by a determination of what is termed calcining capacity. One gram of raw mix after partial calcining under standard conditions should leave a residue of 6—7.5% after treatment with acid and alkali. A spectrographical study of cements of high strength does not show that the presence of small amounts of rare elements, such as beryllium influence the strength as in the case of steels.

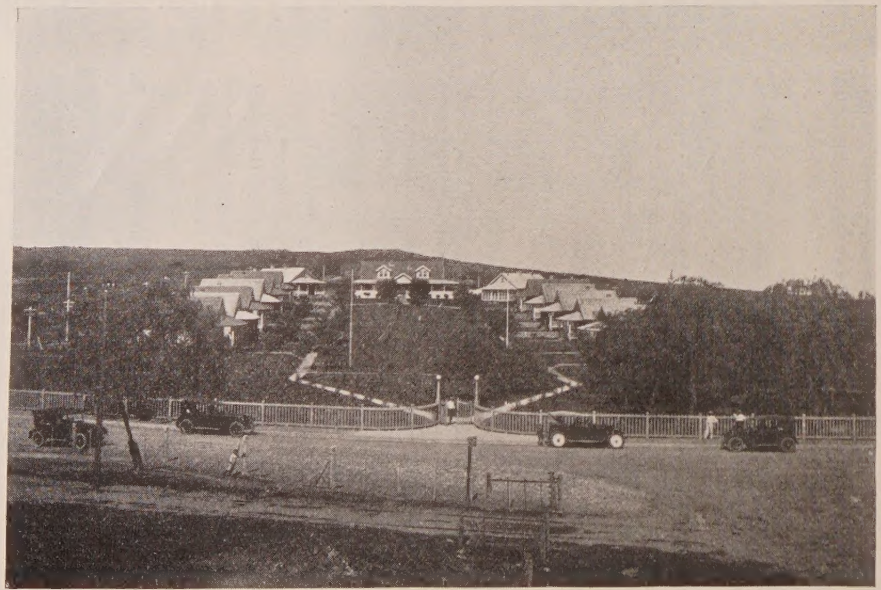
Experiments on variations in the speed of calcining and of cooling and a microscopical study of the resulting products, show that greater strength is obtained the larger the crystals in the clinker. Two kinds of crystals are observed, one with strong double refraction. The hydraulic properties of portland cement are attributed, however, entirely to the non-birefringent kind.

Soft aluminous cement was found to be a mixture of two crystalline components—aluminates and silicates in a vitreous base of iron—and not aluminates in iron silicate as hitherto supposed. Here the non-birefringent crystals are identical with the alit of portland cement.

A study of tensile strengths under varying "fineness moduli" while again emphasizing the importance of large crystals, shows that fine grinding of the clinker will correct faults in the less easily regulated processes of calcining and cooling. Calcining capacity can be improved in its turn, thus increasing the output of the kiln and quickening the speed of calcining







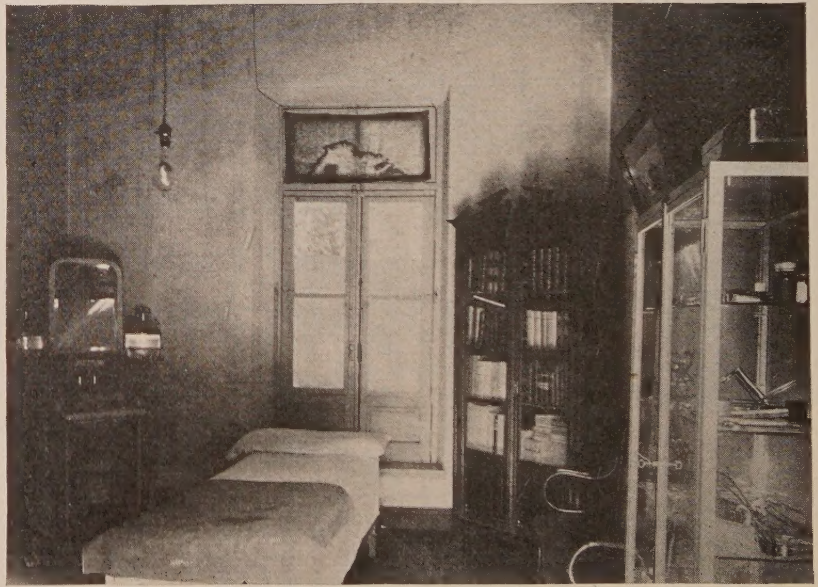


Fig. 1—General view of Argentine plant of International Cement Corp. Waste heat boiler installed. Burns either coal or oil

Fig. 2—Argentine plant town site showing homes of employes

Fig. 3—School house, Argentine plant, Sierras Bayas. Master's residence above

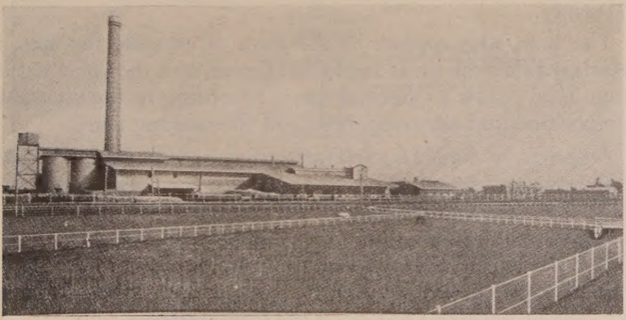
Fig. 4—Doctor's room, Argentine plant

International Cement Corporation Expanding

The International Cement Corporation with head offices in New York City is expanding its South American plants including both the Argentine plant at Sierras Bayas and the Uruguayan plant at Montevideo. About two million dollars will be expended. The improvements now under way at the Argentine plant cover the enlargement of the factory to produce 1,200,000 bbls. per year, the actual equipment being installed to include an additional 10 x 170-ft. kiln, two additional Hercules mills, two 7 x 26 ft. tube mills and an additional waste heat boiler. These improvements are all being made at the mill, located at Sierras Bayas.

At Buenos Aires a property within the city limits, located on the Southern Railroad, has been purchased and a complete silo storage plant, with packing and sack handling equipment, is being erected thereon, thus giving the Argentine company a service station with a large storage capacity of finished product right in the city of Buenos Aires, where, during normal times, approximately 2,000,000 bbls. are consumed.

The property purchased is sufficiently large to accomodate an entirely new plant if the demand for additional capacity, over and above that of our Sierras Bayas mill, should ever arise. This plan is in line with the general policy of the International Cement Corp. to establish its plants within the limits of consuming territories.



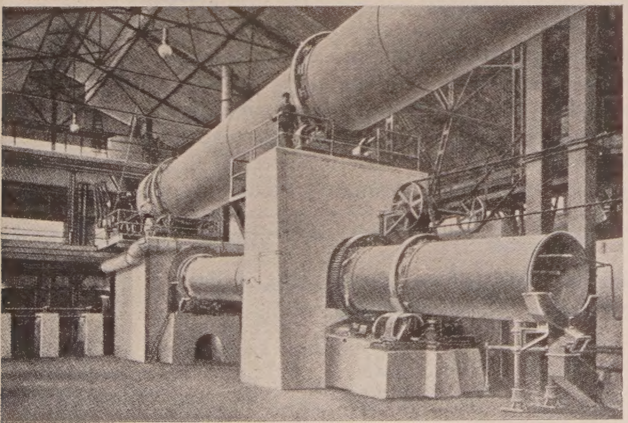


Fig. 5—General view of Uruguay plant, International Cement Corp.

Fig. 6—Interior view of one of the two kiln units with underlying cooler

In Uruguay the company is practically doubling the capacity of the present plant located at Montevideo by the lengthening of the kilns and the installation of additional grinding machinery. Additional warehouse capacity is also being provided, thereby placing the Uruguayan company in the same favorable position as that held by the company in Argentina in the matter of rendering prompt and efficient service to the trade.

British Quick Hardening Cement

By A. C. Blackall

For some time past Professor S. M. Dixon has been prosecuting experiments in his laboratory at the City and Guilds Institute, South Kensington, London, on a cement which hardens in much less time than ordinary portland cement. This new cement is, in fact, a true portland cement, and differs from the rapid-hardening ciment fondu, which is an aluminous cement of French manufacture. Although it does not harden quite so quickly as ciment fondu it possesses the advantage of being cheaper.

For the tests two series of reinforced concrete beams have been prepared, one series being made with ordinary portland cement and the other with the new product, and the crushing loads which two beams of each kind will bear at different stages have been ascertained. At the age of about 54 hours tests on two beams made with ordinary cement gave an average value of about 3,900 lbs., whereas the average figure for the two made with the new cement (which is known as rapid-hardening ferrocrete) was about 14,480 lbs.

At 100 hours the corresponding figures, in all cases the mean of two tests, were about 6,600 lbs., and 19,140 lbs.; at seven days 8,340 lbs., and 21,720 lbs.; and at 14 days 12,420 lbs., and 24,370 lbs. It will thus be seen that the ferrocrete beams are about as strong at the age of two days as the ordinary beams at 14 days. Used for road foundations the new cement would become strong enough in 48 hours to bear traffic, and thus would considerably expedite the process of street repair as compared with ordinary cement which must be allowed to harden for five or six times as long, while in reinforced concrete buildings it would permit the shuttering to be removed in much less than the month usually specified.

The following is a summary of the results of Professor Dixon's tests with ferrocrete and ordinary portland cement beams and cubes. In each case the table gives the higher figure for the two tests carried out:

Cement	Age (Days)	First Tension Crack Lb.	First Compression Crack Lb.	Maximum Load Lb.	Form
Portland.........	2	3,880	4,130	4,130	Beams
Ferrocrete.......	2	7,240	14,380	14,990	Beams
Portland.........	2	695	......	......	Cubes
Ferrocrete.......	2	2,810	......	......	Cubes
Portland.........	4	4,380	6,730	6,860	Beams
Ferrocrete.......	4	4,600	18,550	19,680	Beams
Portland.........	4	1,265	......	......	Cubes
Ferrocrete.......	4	4,086	......	......	Cubes
Portland.........	7	4,575	9,260	9,260	Beams
Ferrocrete.......	7	5,430	22,195	22,545	Beams
Portland.........	7	1.197	......	......	Cubes
Ferrocrete.......	7	5,600	......	......	Cubes

(Note: All the slabs were 16 ft. long by 6 in. wide by 10½ in. deep and weighed about 1,290 lb. All cubes were 6 in. side.)

From this table it will be seen that although the point at which the first tension crack appears does not differ very widely for the two cements, the figures for the compression crack vary to a much greater degree, while the maximum loads show an extraordinary difference. In fact, from these results it is apparent that the tension and compression limits of portland cement are about the same, while in the case of ferrocrete the first compression crack does not appear until anything from twice to five times the load has been applied after the appearance of the first tension crack.

As a result of these highly favorable tests, a section of Piccadilly, London, is now in course of being repaved, half with the French ciment fondu and half with ferrocrete. The work is being done in longitudinal halves, one section being laid with the French cement and the remaining 125 yards with the British cement. With favorable weather, the entire work of breaking up and relaying should be accomplished within three weeks.

Cements From Blast Furnace Slags in France

By P. Prevost

PARIS FRANCE

Slags from blast furnaces are the most cumbersome residues of metallurgical industry; the storing of these materials is an important operation requiring big expenditures if we consider that the production of one ton cast iron gives from one to two tons of slag.

Laborious researches have been effected to utilize these residues; they all have led to two kinds of treatment:

The grinding by mechanical means.

The sanding by means of cold water.

The results obtained have been very different one from the other in the industrial appliances where the slag treated could be utilized.

Grinding. At the time of the evacuation of slag, which operation precedes the tapping of cast iron, the liquid slag is received in pig irons and is left cooling until it takes the appearance of a glassy mass through natural cooling in the air.

The grinding permits of reducing the product into elements of the size of paving pebbles and of using it for the macadaming of roads or in concretes. In practice such a plan had to be practically abandoned on account of the final high cost of the grinding.

We must mention the fact that the technical results obtained in the manufacturing of concretes, where the ground slag takes the place of stones, gravel and sand, are interesting; and we refer the readers that would be interested to the essays of Raymond Harsch about the "Blast Furnace Slag as an Aggregate in Concrete," as also to the tests effected by S. W. Stratton, Director, Bureau of Standards, Department of Commerce, Washington. This process not having been used industrially, will not be referred to further here.

Granulation or Sanding.—On the other hand, the operation consisting in granulating the slag, gives results extremely interesting, on account of the industrial use of the granulated or sanded slag that can be made in the cement industry.

The granulation of the slag is done as follows:

The liquid slag is, at the time of its tapping, put in contact with a considerable quantity of cold water. The result is a granulation that transforms the mass into a kind of sand; hence the name of "sand slag."

In practice the *slag* is received on a slanting channel at the bottom of which it encounters a water current sufficiently rapid to drag away the sand slag. The channel end comes to a decantation tank where the slag is taken out again by a steam shovel to be stocked in silos or loaded on wagons. Fig. 1 gives a simplified sketch of an installation.

According to the rate of working of the blast furnace, the slag comes out at a temperature of 1200° to 1450°; it is estimated that 2500 liters (550 gals.) are necessary for the treatment of one ton of slag.

The running speed of the water in the channel should be higher than 2.50 meters (8 ft.) per second to avoid clogging. The slant should not be less than 12%. Moreover, along the channel, supplementary water connections are provided under pressure so as to permit the agitation of the water stream if necessary.

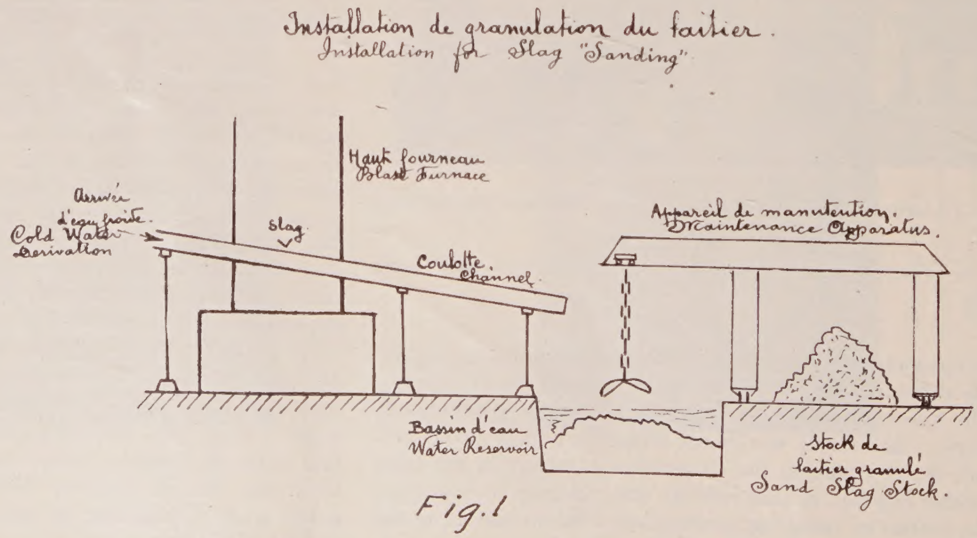
The sand slag appears in the form of crystals the size of which is about the same as grains of sand, and the color varies from light yellow to greenish gray, according to the chemical composition and the temperature of the melting zone.

Properties of Sand Slag.—The sanding process lends remarkable puzzolanic properties to the slag, and these are, as demonstrated by the French savant Le Chatelier, the result of a sudden crystallization, just like a tempering of the slag.

We can technically say that the slag has become reactive on account of the amount of latent energy in it, resulting from the calories absorbed following the granulation.

In fact, the silicates and aluminates constituting the slag are, after crystallization, in a status of equilibrium that can be destroyed without bringing any outside calories, by reaction of these salts on elements capable of giving new stable compounds. That is just what takes place in the presence of lime with a certain quantity of water, when slag and lime are finely pulverized and intimately mixed. It was the observa-

Fig. 1—Installation for slag sanding or granulation



tion of this remarkable property that has given origin to a notable industry, the industry of Slag Cements.

MANUFACTURING OF CEMENTS ON A SLAG BASIS

History.—It was not until the dawn of 1880 that the first trials were effected in Europe for the utilization of slags in cement manufacture.

Since this time the slag factories have rapidly developed; both in France and Germany and Belgium they have taken a considerable extension, specially during the last 20 years.

In France, the accurate care used in the production of cements, the renown of the firms specializing in the manufacturing of slag cements, have permitted the new industry to expand considerably. The annual consumption of cement works in France is at the present time nearly 750,000 tons of sand slag.

There are two kinds of treatment used: in one of them the slag undergoes a baking operation after being mixed with calcite; in the other the slag is simply ground with other substances added.

We are recapitulating, hereafter, in a table, the different fabrications resulting from these treatments.

Sand Slag	Baking Treatment	Calcite Addition	Artificial Portland Cement.
	Grinding Treatment	Clinkers Addition	Iron Portland Cement
		Lime Addition	Slag Cement Rapid Hardening Slag Cement

Treatment of Slags by Baking.—About 150,000 tons of slag is utilized in France for the manufacturing of artificial portland cement; the slag plays the same role as clay marls and is added with calcite so as to correspond to the typical composition of the artificial portland cement.

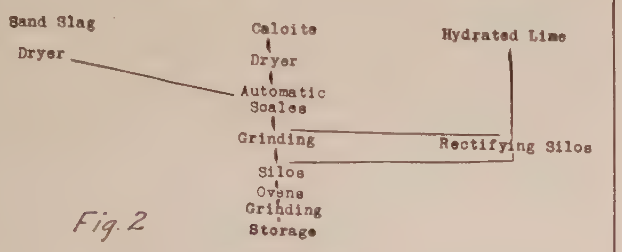


Fig. 2—Scheme for artificial portland cement manufacture

We are hereafter giving the scheme of the artificial portland cement fabrication: (Fig. 2).

Grinding Treatment.—Six hundred thousand tons of slag are utilized by grinding, either mixed with clinkers of cement, or with hydrated lime.

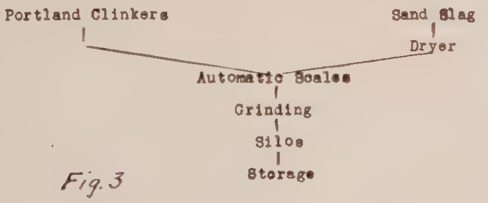


Fig. 3—Scheme for manufacture of iron portland cement

The Iron Portland.—The manufacturing scheme as given in Fig. 3 is sufficiently explicit to show the process adopted.

Proportion used:

Iron Portland Cement	70% Clinkers 30% Slag
Portland Slag Cement	40% Clinkers 60% Slag.

The iron portland cement is a product of the very first grade and is used just the same as the artificial portland for the fabrication of the reinforced concrete.

The portland slag cement is extensively used in Europe for sea work.

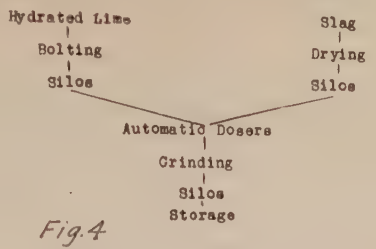


Fig. 4—Scheme for manufacture of slag cement

The Slag Cement.—This cement is manufactured simply by mixing and grinding slag with hydrated lime, following the method schematized hereafter in Fig. 4.

This cement gives excellent results, as it may be appreciated by the following table.

The slag cement is used in competition with the artificial portland in highway and foundation work, but we shall consider at length in a special chapter the progress realized especially with the rapid-hardening slag-cement and its appliances.

TABLE OF RESISTANCE PER SQUARE CENTIMETER, IN KILOS:

		2 days	7 days	28 days	3 mos.	6 mos.	9 mos.	1 yr.	2 yrs.
Slag Cement	Tension	13.1	20.5	27.5	33.5	34.	35.	36.2	37.
	Compression		108	157	184	212	230	244	278
Artificial Portland Cement	Tension	16.4	26.8	30.7	35.4	38	39.2	41	42
	Compression		175	279	381	418	431	460	475

The above resistances to tension and to compression were obtained with cements from good French makes, the gauges being made out of beaten mortar, according to the method in use at the Municipal Laboratory of the City of Paris, 2 Place Denfert-Rochereau, Paris.

Composition of Slags and Hydrated Limes.—In the manufacture of cements, only those slags the composition of which is well determined should be used.

First of all, slags designated as acid slags, should be eliminated, the proportion for which is: $\frac{\text{Silica}}{\text{Lime}} : \frac{SiO_2}{CaO} > 1$, to utilize only slags cleanly basic, obtained in blast furnaces working hot and producing, molding cast-iron and refining cast iron for steel mills.

The best results are obtained with slags that are strongly calcic and for which $1.2 < \frac{CaO}{SiO_2} < 1.6$.

On the other hand, the proportion or ratio $\frac{\text{Alumina}}{\text{Silica}}$ must respond to the condition $0.45 < \frac{Al_2O_3}{SiO_2} < 0.50$.

We are giving hereafter the limits of chemical composition admitted in industrial practice:

Chemical Composition of Sand Slags:			
	Silica	SiO_2	27 to 33%
	Lime	CaO	36 to 50%
	Alumina	Al_2O_3	12 to 20%
	Sulfuret of Calcium	CaS	2 to 8%
	Magnesia	MgO	0 to 4.5%

As to limes little difficulties are encountered, as they suit in their almost totality the requirements of the slag-cement making.

It is sufficient that the Magnesia contents (MgO) are no higher than 4%.

Here are the most interesting limits of composition:

Silica	SiO_2	1 to 15%
Lime	CaO	65 to 95%
Alumina	Al_2O_3	1 to 5%
Magnesia	MgO	0 to 4%

Fabrication of Slag Cement.—Slag granulated in water contains 15 to 25% of water, and must be dried before it is mixed with the lime.

The operation is effected most often in a drier of the revolving type with direct flame and the gases circulating in the same direction as the motion of slag.

Drier towers with gravity dropping of the slag are also used and give satisfaction.

In this operation, the direct contact of the slag with the flame should be avoided: a devitrification would follow that would destroy almost entirely the pozzuolanic properties of the slag.

A microscopic study permits of examining the faults in granulation the same way as devitrification: the two phenomena appear under the same form.

The slaked lime is mixed with the dried slag in different proportions varying of course according to their respective compositions.

Slag enters in the proportion of 70 to 80%, and lime in the proportion of 20 to 30%, in the fabrication of slag cement. The mixture is then finely ground in a finishing tube, after passing through a preliminary grinder with big balls in which the hard parts of slag are crushed.

A capital importance is attached to the obtaining of a great fineness, so as to assure the greatest number of contact points between the constitutive elements of the mixture.

It is generally accepted that a good quality slag cement should not leave more than 10% residue on a sifter having 4900 meshes per sq. cm.

Slag being a very hard product, it is necessary to have available a strong equipment, with casing plates of manganese steel.

The obtained product is put up in silos for storage, and then shipped.

Net Cost.—With a view to giving an idea as to the net cost of this product, we are giving the average data that we have noted in various factories, concerning the raw materials, power and fuels.

For the fabrication of one ton cement, it takes:

Raw Material	800 Kilos Dried Slag. 200 Kilos Hydrated Lime.	
Power Necessary for	Grinding	38 H. P.
	Drying	4 H. P.
	Silos and Bagpackers	3 H. P.
	Total	45 H. P.
Drying Fuel	35 Kilograms.	

CONCLUSIONS

The above figures show prominently the very reduced price (net) of the slag cement manufacture.

We may have an idea of the development of cement industry in metallurgical districts, by considering the tremendous production of slag by metallurgical factories.

England and United States, however, have still only timidly entered this path.

In England, only one factory, using slag the cold way, was started a few months ago; whilst in France, Germany and Belgium, more than 50 factories can be counted.

The progress realized lately in the technical field of the manufacture and introduction, onto the French market in 1922, of the rapid hardening slag cement, have keenly interested all engineers and contractors.

It is our intention, in a following article, to mention the features of the rapid hardening slag cement, as well as the kind of work that it has made possible to realize.

Lime in 1924

The lime sold in the United States in 1924 amounted to 4,022,000 short tons, valued at $38,670,000, according to estimates furnished by lime manufacturers to the Department of the Interior through the Geological Survey. These figures show a decrease of a little more than 1% in quantity and 3% in value from the sales in 1923. The sales of hydrated lime, which are included in these figures, amounted to 1,292,000 tons, valued at $12,972,000, an increase of about 5% in quantity and 6% in value. The average unit value of all lime showed a decrease from $9.81 a ton in 1923 to $9.61 in 1924, and that of hydrated lime an increase from $9.98 a ton in 1923 to approximately $10 in 1924.

About 53% of the total output was used in building, 41% in chemical industries, and 6% in agriculture. Ohio, the leading State, showed an increase of 9% in total sales and 7½% in sales of hydrated lime. Pennsylvania, which ranked second, showed a decrease of 14%. Of the 22 States in which more than 25,000 tons were sold, only 8 showed increased sales. The demand for building lime differed greatly in different States.

The sales of chemical lime also varied, but most of the producers reported decreases or practically no change. The final figures may show increased sales in New York, Indiana, Missouri, Alabama, and a few States that are small producers, but the total sales will probably be a little less than in 1923.

The demand for lime for use in agriculture was about the same as in 1923 in most States, but in Maryland and Virginia, which rank among the large producers of lime for this use, the sales will doubtless be less than in 1923.

The accompanying table shows the estimated sales of lime in 1924 and the sales in 1923 for comparison.

LIME PRODUCED IN THE UNITED STATES IN 1923 AND 1924

State	1923				1924 (Estimated)			
	Hydrated Lime (Short Tons)	Total Lime		Average Value Per Ton	Hydrated Lime (Short Tons)	Total Lime		Average Value Per Ton
		Short Tons	Value			Short Tons	Value	
Ohio	601,082	867,982	$8,740,688	$10.07	646,000	945,000	$9,377,000	$ 9.92
Pennsylvania	177,836	772,839	6,372,732	8.25	177,000	679,000	5,465,000	8.05
Wisconsin	19,736	227,549	2,055,646	9.03	18,600	245,000	2,190,000	8.94
West Virginia	52,954	241,601	2,029,061	8.40	14,000	234,000	1,840,000	7.86
Missouri	63,823	246,326	2,505,785	10.17	63,300	231,000	2,178,000	9.43
Alabama	19,526	193,429	1,627,539	8.41	22,700	212,000	1,754,000	8.27
Massachusetts	(a)	180,720	2,550,575	14.11	(a)	190,000	2,763,000	14.54
Virginia	32,189	182,604	1,490,306	8.16	36,000	170,000	1,356,000	7.98
Maine	(a)	139,781	1,946,486	13.93	(a)	124,400	1,671,000	13.43
Tennessee	40,558	131,995	1,028,158	7.79	38,000	117,000	923,000	7.89
Indiana	43,051	126,296	1,151,083	9.11	44,700	116,000	985,000	8.49
New York	(a)	100,862	1,037,737	10.29	(a)	99,000	978,000	9.88
Illinois	15,590	92,633	978,658	10.56	22,600	96,000	1,034,000	10.77
Michigan	(a)	59,629	612,369	10.27	(a)	73,000	704,000	9.64
Texas	22,935	62,822	606,976	9.66	25,400	62,000	584,000	9.42
Connecticut	(a)	59,158	813,254	13.75	(a)	58,500	797,000	13.62
Vermont	(a)	58,681	702,588	11.97	(a)	58,400	677,000	11.59
California	(a)	66,703	869,979	13.04	(a)	52,000	633,000	12.17
Maryland	34,783	63,858	553,811	8.67	29,000	51,000	421,000	8.25
Washington	(a)	25,895	359,510	13.88	(a)	31,000	387,000	12.48
Arizona	(a)	18,764	264,683	14.11	(a)	26,000	321,000	12.35
Minnesota	(a)	29,805	339,957	11.41	(a)	25,500	286,000	11.22
Undistributed	101,865	126,311	1,356,071	.....	154,700	126,200	1,346,000	.....
	1,225,928	4,076,243	39,993,652	9.81	1,292,000	4,022,000	38,670,000	9.61

(a) Included under "Undistributed."

Canadian Lime Companies Merge

One of the biggest transfers in lime properties in many years, was recently effected whereby all the lime plants and lands of the Stetson, Cutler Co., were purchased by the Fraser Companies, Limited. Fraser Companies are a merger of various organizations covering the pulp, lumbering and lime fields. The late Donald Fraser Sr. founded the Fraser Lumber Co. about 60 years ago, with head office at Fredericton. The affiliated concerns are now headed by Archibald Fraser as president and Donald Fraser Jr. as vice president. Although the head offices are still in Fredericton, the lime manufacturing plants are at Plaster Rock on the Tobique River and Edmundston on the upper St. John river, on the New Brunswick shore. The lime manufacturing scope of the Fraser business has been greatly enlarged during the past 10 years, new plants having been opened and new equipment installed, particularly on the Tobique river.

The addition of the Stetson, Cutler Co.'s plants and properties will increase the holdings of the Fraser Companies about 35%. St. John was the headquarters of this company, several of the company's plants being located in a suburb known as Pokiok. These plants have excellent shipping facilities on the water, being located on the water's edge, at the mouth of the St. John river. The bulk of the lime has been shipped by schooner to the United States, although some has been shipped by rail. The chief drawback is the distance of the plants from the railroads. To the Canadian Pacific and Canadian National the distance overland is about two miles. This necessitates the use of heavy wagons.

The Stetson, Cutler Co. also had lime manufacturing plants along Bay of Chaleur, Restigouche river and Nepisiguit river. These have all become the property of the Fraser Companies in the big transfer.

At present no announcement is available, as to the plans of the new owners, but indications are that the output of lime by the Fraser Companies during the 1925 season will be far greater than during 1924. The acquisition of the Stetson-Cutler plants will mean an increase in shipments of lime to the United States. The Fraser Companies have been exporting annually, more lime than any other of the Eastern Canadian lime producing concerns.

Mergers of lime interests have been rather infrequent in Canada. An intimation is given that a strengthening of the lime market is looked for this year. For several years, the market has weakened, and on this account, some of the lime companies did not operate their plants. They have been waiting for a turn in the market and may resume operation during 1925.

New Titan Cement

We are informed by Mr. Edwin C. Eckel that the Titan cement patent in France has been taken out in the name of the Societe des Ciments de Lafarge. Applications for the two patents covering the Fer-Al process have been forwarded to France for similar use by that company, which is best known here as the originator of ciment fondu.

The two Cuban patents covering the Fer-Al cement process have been transferred to Royal Basset of New York City.

Negotiations involving the transfer of Titan and Fer-Al rights in other European and Spanish American countries are well advanced, and it is probable that their results can be announced shortly. No announcement will be made regarding State or Provincial licenses granted within the United States or Canada, as such licenses are matters of individual interest, only.

Peerless Company Sells Bond Issue

An issue of $1,750,000 of first mortgage serial 6½% gold bonds has been disposed of by the Peerless Portland Cement Co. through Peabody, Houghteling & Co., investment bankers, Chicago. The bonds are secured by a direct first mortgage on all of the physical assets of the company, including the finished cement plant at Union City, Mich., and the new Detroit plant. The Peerless Portland Cement Co. has under construction and nearing completion a modern cement plant on the River Rouge within the city limits of Detroit, with an annual productive capacity in excess of 1,500,000 barrels. According to Col. William M. Hatch, president of the Peerless Portland Cement Co., the Detroit plant will have a market within a radius of 15 miles, estimated at 3,000,000 barrels of cement annually, distributed there at an average freight rate of 40c per bbl. and a minimum rail freight rate from the nearest competing plant of 25c per bbl. The plant is designed to use waste heat boilers which will result in a substantial saving in coal consumption and it will obtain its supply of stone by a long time contract for crushed limestone delivered on its dock by the Michigan Limestone & Chemical Co. Self unloading boats will be used in transportation. It will also use caustic waste as a limestone substitute from the adjoining plant of the Solvay Process Co., at an estimated substantial saving in stone cost.

Phoenix Portland Cement Company Expanding

The Phoenix Portland Cement Co. has authorized an increase in its capital stock to $4,000,000, and is now prepared to proceed with its proposed new plant at New Orleans.

Work is under way in connection with an addition to its Birmingham plant which will increase the output one-third to a capacity of 2,000,000 bbls. of cement annually. Contracts for the major items of the machinery and equipment for this new addition have been awarded to the following: Vulcan Iron Works, Allentown, Pa., Bradley Pulverizer Co., Allentown, Pa., Traylor Engr. & Mfg. Co., Allentown, Pa., Fuller-Lehigh Co., Fullerton, Pa., General Electric Co., Schenectady, N. Y. The actual construction work is being handled entirely by the organization of the Phoenix company.

This addition, which will make the Birmingham plant of the Phoenix Portland Cement Co. the largest cement plant in the south, is made necessary to take care of the constantly increasing business of the company from that point, and if the same rate of increase continues, it is expected to increase the plant to its ultimate capacity for which it was originally designed, of 2,500,000 bbls. annually.

New Plaster Waterproof Cement

The Riverside Portland Cement Co., Los Angeles, Calif., has put out a new product under the name Plastite which is described as a new cement that is plastic, waterproof, strong and durable. It is recommended by the manufacturers for use in mortars and concrete without any of the common admixtures, such as clay or lime, in some form to produce plasticity.

It is claimed for the new product that its waterproof character is permanent and that by reason of its plasticity, an important labor saving may be realized, the waterproof character and plasticity being gained without loss of strength.

Men and Mills

Notes from the Field

The Phoenix Portland Cement Company is adding a unit to its plant at North Birmingham, Ala., which will increase the production of the plant 33⅓% more, making the annual out-put 2,000,000 barrels annually.

While this is the off season for cement consumption, because of weather conditions, there is a large amount of cement being required on the open market and deliveries are constant, from the Birmingham, Ala., district plants.

John L. Senior was re-elected president of the Signal Mountain Portland Cement company at the annual meeting of the stockholders and board of directors held recently in the offices of the Chattanooga Manufacturers' association, Chattanooga, Tenn. Announcement of an offer to purchase the plant for the sum of $4,456,660.13 was made to the stockholders, who voted not to sell.

W. A. Sadd, president of the Chattanooga Savings bank, was elected chairman of the board of directors; J. L. Caldwell, vice president; F. P. Butler, vice president; J. P. Hoskins, treasurer; H. J. Weeks, secretary.

The executive committee is composed of W. A. Sadd, J. L. Caldwell, J. P. Hoskins, D. F. McPherson, H. J. Weeks and J. L. Senior.

The board of directors is composed of the following: F. P. Butler, J. L. Caldwell, F. A. Carter, L. L. Fischer, C. L. Hardwick, J. P. Hoskins, D. F. McPherson, W. A. Sadd, J. L. Senior, E. J. Trimbey, H. J. Weeks, R. G. Wright.

Authorization was given the executive committee to erect such buildings at the plant as will adequately house the office force and a denial of the rumor current in business circles last week to move the offices to Chicago was made by officers of the company.

Out of a total of 55,000 votes, being the entire preferred and common capital stock of the company, there were present in person and by proxy 53,180 votes.

Reports were read by the president and treasurer showing the company in good standing, able to pay its first dividend and predictions were made that 1925 will be one of big business, resulting in large profits for the company.

Llewellyn T. Bachman, who for 17 years has served as assistant superintendent, directing chemist and technical economist for the Santa Cruz Portland Cement Co., at Davenport, Calif., has recently resigned his position to apply himself to a wider latitude in the cement industry.

He is particularly well known for his activities in the Portland Cement Association and its technical committees and for his diligent pursuit in research and development of better concretes and processes.

He has just returned from an inspection of cement plants in the United States and is now identified as superintendent and directing chemist with the Peralta Portland Cement Co., of Oakland, Calif., with temporary offices at 1010 French Bank Bldg., 110 Sutter St., San Francisco, Calif., whose activities will for the present be confined to the Pacific Coast.

A banquet of the salesmen of the Phoenix Portland Cement Co. was held recently in New York City.

W. Y. Stroh, president of the Stroh Steel-Hardening Process Co., Pittsburgh, Pa., with his family sailed on the Berengaria, February 7, for England and the continent. It is predicted that the production of Stroh Steel will be undertaken in England in the near future.

Plans for the construction of the first plant unit of the new American Portland Cement Co. in the Imperial Valley, near Los Angeles, Calif., are progressing according to a report by W. L. Peck, president and general manager of the company. The proposed plant will consist of 3 units, each having a capacity of about 1,000 bbls. of cement daily. The first unit, which it is estimated will cost about $750,000, will be followed by the construction of the other two units planned.

The company's property is reported as including about 1,200 acres covered to a depth of about 30 ft. with a soft shale which has been found ideal for the manufacture of portland cement.

An explosion in the cement plant quarry at Rapid City, S. D., recently proved fatal to Horace Edward Pfeiffer, of York, Pa., an employe at the plant and a senior student at the South Dakota State School of Mines.

The annual meeting of the stockholders of the Alpha Portland Cement Co. was held recently in Jersey City. The reports of officers showed that the company had a most successful year and that prospects were excellent for the coming year.

The following directors were elected: James H. Lockhart and J. M. Lockhart, of Pittsburgh; Louis H. Porter, New York City; G. S. Brown and Frank G. McKelvey, Easton; F. M. Coogan, Phillipsburg; C. K. Boettcher, Denver, Colo.; C. H. MacNider, Mason City, Iowa, and C. A. Irvin, of Chicago, Ill.

The directors organized by electing G. S. Brown as president; Frank G. McKelvey, F. M. Coogan and C. A. Irvin as vice presidents; John G. Matthes, Phillipsburg, treasurer; F. G. Lyons, Easton, assistant secretary and assistant treasurer; Robert S. Gerstell, Easton, secretary; W. E. Viets, Chicago, assistant secretary and assistant treasurer.

At the big "get-together" meeting of the Rocky Mountain branch of the Associated General Contractors of America, held in Denver, January 28, one of the principal speakers was Fred Schmidt of the Portland Cement Association. Mr. Schmidt devoted his talk to the report of the Associated General Contractors Convention at Washington, as compiled by F. C. Dreher.

The annual meeting of the stockholders of the Lehigh Portland Cement Co. was held in the Young building, January 10, with a large representation in attendance. No figures were given out, but it was learned that the chain of Lehigh portland cement mills throughout the country shipped more cement last year than the mills of any other country in the world.

The following directors were elected: General Harry C. Trexler, Colonel Edward M. Young, George K. Mosser, John D. Ormrod, and Daniel E. Ritter.

Following the meeting the officers and out-of-town stockholders attended the annual dinner at the Livingston Club while the stockholders, superintendents of the different mills and the office force attended a dinner at the Elks' Club, where an interesting program was arranged.

Dixie Portland Cement Co. officials are reported to have announced that they intend spending about $200,000 this year on betterment of the plant. New equipment was installed last year, the plant electrified and thoroughly modernized.

John R. Morron, president of the Atlas Portland Cement Co., New York City, is one of a representative group of business men quoted in *System* who agrees with Albert H. Gary in looking for great business prosperity for 1925. Mr. Morron states "I believe we shall not be harrassed as much during this period as in the past by the obstruction of discontented individuals and politicians who penalize success and capitalize notoriety. This being so, I believe that 1925 will see a continuance of building and industrial progress."

The Dings Magnetic Separator Co. of Milwaukee, Wis., builder of magnets, magnetic pulleys and separators, announces the appointment of C. R. Considine as its representative in Iowa and Minnesota territory. Mr. Considine will handle this business from 1022 Langworthy St., Dubuque, Iowa.

Clarence S. Steward tendered his resignation in January, as vice president of the Signal Mountain Portland Cement Co. and it was accepted by the executive committee meeting in special session.

Checks covering all accumulated divendends on preferred stock since the organization of the company in 1920 have been mailed out. Total amount of dividends paid is $106,660.13, the total issue amounting to $2,500,000, 8% cumulative preferred stock.

At the present time the third unit to the mill is being erected. The present two-unit installation has an annual capacity of 1,000,000 barrels of cement, and the unit now being erected, which will be ready for operation this summer, will add 50% to the present production. The original plant was laid out so that additional units up to 10 could be installed without interruption to the operation of units already completed.

No additional storage space for raw materials, work in process or finished cement will be required, as the facilities now available are sufficient to care for the output of three units. The improvements consist principally of the installation of new machinery and some enlargements to mill buildings.

A list of the major items of machinery to be installed, to gether with the names of the manufacturers, are reported as follows:

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., No. 726 wet grind compeb mill, No. 726 dry grind compeb mill, 11x175-ft. rotary kiln, 8x70-ft. rotary cooler, two 500 h. p., 180 rpm, 220 volt, 3 phase, 60 cycle synchronous motors with magnetic clutches; auto transformers and starting panels, a 27½ kilowatt, 1750 rpm, 125 volt, D. C. generator; a 440 volt, 60 cycle, 3 phase motor exciter set complete with starter and D. C. field rheostat; 75/30 h. p., two-speed (700-348 rpm), slip-ring motor; 100 h. p., 495 rpm, cage motor;25 h. p., 685 rpm, slip-ring motor, 20 h. p., 1150 rpm, cage motor, and two 5 h. p., 675 rpm, cage motors.

Fuller-Lehigh Co., Fullerton, Pa.: 6-in. Type C Fuller-Kinyon pump and Y-casting, etc., for connecting; 46-in. gear driven, screen type Fuller-Lehigh pulverizer, and 6-in. pulverized coal feeder.

Chattanooga Boiler & Tank Co., Chattanooga: Stone tank for raw grind department, double Fuller mill tank, kiln coal tank, and bin for finish grind department.

Walsh & Weidner Boiler Co., Chattanooga: Extension for raw grind building, sections for finish grind building, two sections of burner building, and smokestack 8 ft. in diameter and 125 ft. high.

F. M. Pinnegar, formerly general salesmanager of the Kelley Island Lime & Transport Co., Cleveland, Ohio, has become affiliated with the Palmer Lime & Cement Co., New York City as assistant to the president. Mr. Pinnegar's broad experience in sales executive management makes him unusually fitted for this broader executive work.

Mill B, of the Coplay Cement Co., recently resumed operations after an idleness of two months during which general repairs were made. With the resumption of this work, the Coplay plant went on a full time basis.

The central plant of the Giant Portland Cement Co. at Egypt is again in operation as is also the Reliance plant.

Cement is moving briskly in the Lehigh district, many contractors receiving their spring shipments now. The mills anticipate a very busy year and most of them will be unable to fill their storage houses prior to the opening of the spring season.

Frank Groff, a foreman in the Edison Cement Co.'s plant at New Village met with an accident recently which necessitated the amputation of his arm.

The suit brought by the Brown Instrument Co., Philadelphia, in the Federal Court of Chicago against the Republic Flow Meters Co. and certain individuals based upon the alleged infringement on the Brown Instrument Co.'s patent covering the construction of indicating and recording pyrometers has been settled out of court, to the satisfaction of both companies. Also certain suits brought by the Republic Flow Meters Co. and the same individuals in the same court against Richard P. Brown, have been dismissed.

The Republic Flow Meters Co. has changed the construction of its indicating and recording pyrometers to avoid any question of infringement either of patents or of original design or construction of the Brown Instrument Co., it having been called to the attention of the Republic officials that there were pending on behalf of the Brown Instrument Co. patent applications covering some of these features.

Thomas Haffner, draftsman at the Phoenix cement plant Bath, for over a year, left recently for Birmingham, Ala., where he is now employed in the new Phoenix plant.

Stockholders of the Missouri Portland Cement Co. have approved the recommendation of the directors that the stock of the company should be increased from six to nine million and the par value of the shares should be changed from $100 to $25 per share, thereby increasing the number of shares from 90,000 to 360,000, the stockholders to receive four shares of the new stock for each one they hold. The stock pays 7% annually and has ranged from 94 to 154 during 1924.

The Wolverine Portland Cement Co. for the year ended December 31, 1924, reports net earnings of $297,212 after federal taxes, equivalent to $2.97 a share earned on $1,000,000 capital stock. Current assets were $469,697 and current liabilities $20,150; cash totaled $255,831.

Huston Rawls of Howe, Snow, Berties & Co., was elected a director with W. G. Cowell of Coldwater, Mich. C. C. Jones, president, stated he anticipates even better business in 1925 than the record 1924 showing.

Reports from Nashville, Tenn., indicate that good progress is being made by the Southland Portland Cement Co. New headquarters for the company have been opened in Chattanooga and a $1,500,000 plant is planned for Crab Orchard in Cumberland Co. The company owns 9,000 acres of land on which are deposits of shale and limestone. Work on a 3,000 bbl. plant was scheduled to start in February. James O. Baker, formerly of New York City is president of the new company.

Ball-Bearing Chain Block

The Yale & Towne Mfg. Co., of Stamford, Conn., has recently designed and placed on the market a new ball-bearing chain block. The introduction of large capacity ball bearings which support the load sheave, is the latest important step in a long series of improvements in this block.

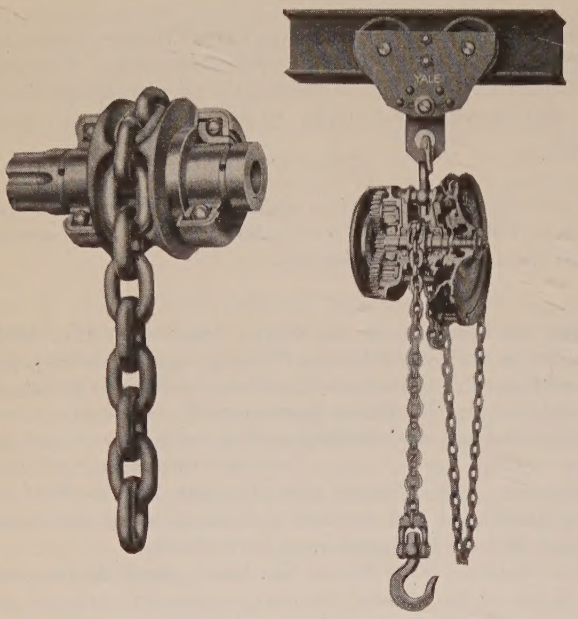


Fig. 1—Large size ball bearings to support the load sheave

Fig. 2—Sectional view of the block and the location of the massive steel load sheave carried on two ball bearings, each containing vanadium steel balls

These ball bearings are so situated that they carry or support the full load, and the manufacturers claim that this latest improvement reduces friction, adds to the life of the block, and greatly increases its efficiency.

Worm-Gear Reducers for Vertical Drives

A complete line of worm gear reducers has been designed by the D. O. James Mfg. Co., 1114 W. Monroe St., Chicago, Ill., to meet the demand for a vertical drive for agitators, mixers, driers, screw conveyors and other machinery. The James vertical and angle reducers are described by the manufacturers as small, compact, noiseless, powerful and of a nature to allow the motor to be placed at a distance away from the drive itself, thus eliminating danger of spoiling the armature windings due to vapors, gas or steam arising from tanks or tubs over which they operate.

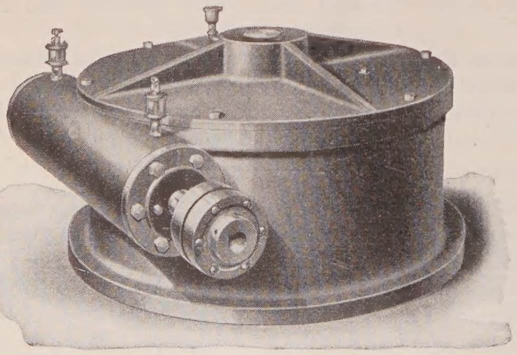


Fig. 1—Worm gear speed reducer for vertical drive

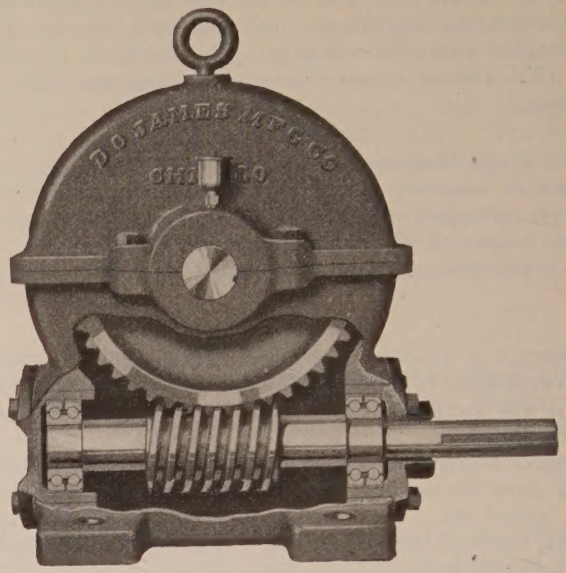


Fig. 2—Speed reducer for angle drive

The angle type worm gear reducer is designed to meet the demand for a small compact unit that can be tucked away in the corner or for driving a slow moving belt conveyor where the drive is placed alongside the conveyor instead of extending out into the room. It is claimed that this type of equipment is unaffected by heat, cold, moisture abrasive dust, acid, gas or steam.

Trade Publications

The Gilman Manufacturing Co., East Boston, Mass., has issued *Bulletin No. 101* describing mounted rock drills for the mine, quarry, and contractor. This bulletin is 6 in. x 9 in. and contains 32 pages, describing and illustrating the Bantam drifter hammer rock drill, light drifter hammer rock drill, pneumatic feed drifter hammer rock drill, heavy drifter hammer rock drill, pneumatic feed heavy drifter hammer rock drill. Details of construction for the Gilman equipment are included stressing upon the outstanding mechanical features involved. Equipment for drilling with water under pressure as well as for drilling dry holes is given for the various types of drills. *Bulletin 100* describes and illustrates hand held rock drills for use in mine, quarry and the contractor, and *Bulletin 102* describes and illustrates the Gilman automatic heat treating machines for rock drill bits.

The W. W. Sly Manufacturing Co., Cleveland, Ohio, has issued a 4-page circular under the title, *Dust or Dollars.* Among the illustrations of Sly dust arrestors are those in the rock crushing, mining, ceramic, lime, steel and portland cement fields.

The Manitowoc Shipbuilding Corp., Manitowoc, Wis., has issued an 8-page bulletin on cement mill equipment with particular reference to the kiln and cooler. The bulletin is illustrated by view of cement mill equipment including the installation at the Manitowoc Portland Cement Co.'s plant, Manitowoc, Wis.

The Pennsylvania Crusher Co., Philadelphia, Pa., has issued *Bulletin No. 50* containing illustrations and a brief description of the new Pennsylvania Armorframe, single roll, coal crusher. This bulletin is in folder form, 4 in. x 7¼ in. and shows sectional views of the new type of crusher outlining the outstanding features.

The American Blower Co., Detroit, Mich., has recently issued a 12-page bulletin No. 1218, describing and illustrating their new Venturafin unit heaters. It is claimed by the manufacturers that the Venturafin unit heaters are the lightest and most compact heating units of equal capacity yet developed. Some of the advantages claimed are: small space occupied, unusually high efficiency in heat transmission, intimate contact between the air and the coils, absence of leaks, and cost of installation light.